Empirical Studies on the French and Japan's Foreign Trades and Economic Policies

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Contents

I. Introduction :

French economists, Frank Fournelle, Pierre-Alain Muet and Pierre Villa, have analysed "Foreign Trade in France since 1950: An Econometric Study of Aggregate Functions,"(1) in the Annales de l'inséé, Numéo 49, Janvier-Mars 1983. In the following article, we are going to examine their explanations of foreign trades in France in detail and first to take account of the theoretical foundations for the usual foreign trade functions,(2) and the conditions for the aggregation of these functions.(3) Secondly, we intend to consider that the difference between the structure of production at home and the structure of foreign trades requires a distinction on the aggregate between the short-term elasticities of foreign trade relative to home and foreign prices. Finally, we present the results of estimate on imports and exports-functions for France permitting an assessment of the precision with which we can evaluate the direct influence of a devaluation on the trade balance.(4) At the end of this article, we intend to show some econometric studies of Japan's import-functions which have been the most important issues of our economy. We have utilized the Japan's statistical data between 1968 and 1984 and have obtained the significant estimates on Japan's import-functions.(5) We will then addd the result of estimation of Japan's exports by Professor Nakamura(6) to compare with our calculations of Japan's imports.

Note

(1) Frank Fournelle, Pierre-Alain Muet et Pierre Villa, Le Commerce extérieur en France depuis 1950: Une étude économétrique des fonctions agrégées, Paris, Annales de l'inséé, Numéro 49 — Janvier — Mars 1983.

(2) ibid., PP. 53–62.

(3) ibid., PP. 62–68.

(4) ibid., PP. 69–87.

(5) Economic Planning Agency, Government of Japan, Annual Summary Report on National Accounts (Keizai Yōran), 1985, Tokyo, Economic Research Institute, Economic Planning Agency.

(6) Takafusa Nakamura, The Postwar Japanese Economy, Tokyo University Press, Tokyo, 1981, PP., 56–61.

II. French import and export-functions

1. Theoretical foundations

1. 1. Demand-functions

Normal formulations of import and export functions attempt to consider the relations of foreign trades mainly as the demand functions for foreign goods and domestic products. In macroeconomic levels, we can explain them in the following way:[1]

$$M^d = f\left(Q, \frac{P}{P_m}\right)$$

$$X^d = g\left(Q_e, \frac{P_x}{P_x^e}\right)$$

$$\frac{\partial M^d}{\partial Q} > 0, \quad \frac{\partial M^d}{\partial \frac{P}{P_m}} > 0, \quad \frac{\partial X^d}{\partial Q_e} > 0, \quad \frac{\partial X^d}{\partial \frac{P_x}{P_x^e}} < 0,$$

with:

X: Volume of exports

M: Volume of imports

Q: Domestic Production

Q_e: Foreign Production

P_m: Prices of imports in national money

P_x: Prices of exports in national money

P_x^e: Prices of foreign countries in national money (weighted by the structure of exports)

In utilizing a log-linear specification, the relations of international trades are written as follows : [2]

$$(1) \qquad M = Q^{\alpha_m}\left(\frac{P}{P_m}\right)^{\beta_m}$$

$$(2) \qquad X = (Q_e)^{\alpha_x}\left(\frac{P_x^e}{P_x}\right)^{\beta_x}$$

with,

α_m : the revenue-elasticities of import-functions
α_x : the revenue-elasticities of export-functions
β_m : the price-elasticities of import-functions
β_x : the price-elasticities of export-functions

1. 2. Supply-behaviour, equilibrium model and formation of prices in long-term

Certain autors consider that foreign trades can be explained by a demand and supply equilibrium model. They write that the supply depends positively on the rate of scope in import and export, that is to say, the ratio of P_m to P_m^e (P_m/P_m^e) and of P_x to P (P_x/P), as well as the capacities of production in export-industries.[3]

The elasticity of the supply in export relative to the capacity of production must, therefore, be equal to the unity. However, if one takes account of the effects of specialization at the macroeconomic level, one will keep the elasticities superior to the unity. The supply-model will be, for example, the following : [4]

$$(3) \qquad M^0 = (\bar{Q}_e)^{\alpha'_m}\left(\frac{P_m}{P_m^e}\right)^{\delta_m}$$

$$(4) \qquad X^0 = (\bar{Q})^{\alpha'_x}\left(\frac{P_x}{P}\right)^{\delta_x}$$

where $\bar{Q}$ and $\bar{Q}_e$ are the capacities of domestic and foreign production.

The equilibrium prices depend, therefore, on the quantities of production : [5]

$$(5) \quad P_m = (P_m^e)^{\lambda} \cdot P^{1-\lambda} \cdot Q^{\frac{\alpha_m}{\beta_m+\delta_m}} \cdot \bar{Q}_e^{\frac{-\alpha'_m}{\beta_m+\delta_m}}$$

$$(6) \qquad P_x = (P_x^e)^{\mu} \cdot P^{1-\mu} \cdot Q_e^{\frac{\alpha_x}{\beta_x+\delta_x}} \cdot \bar{Q}^{\frac{-\alpha'}{\beta_x+\delta_x}}$$

with

$$\lambda = \frac{\delta_m}{\beta_m + \delta_m} \quad \text{and} \quad \mu = \frac{\beta_x}{\beta_x + \delta_x}$$

However, the estimation of these last models, (5) and[6] (6), do not show the empirical evidences of significant influence in quantities on prices as the complete reduced form would be wished to explain them. Furthermore, the lack of indicators of tensions in the relations determining the volume of foreign trades provide the moderate adjustments in comparison with the usual models integrating these indicators.[7] So we are going to introduce them into our model.[8]

1. 3. A disequilibrium model

The disequilibrium between demands and supplies in domestic and foreign markets will give rise to the situations of both excess-demands and excess-supplies. But, we are not disposed of the direct measures of the excess-demands.[9] On the contrary, the indicators of capacity of production, obtained from the investigation of business cycle, provide us with an evaluation of the excess-supply of firms which are in situation of excess-supply.[10]

The imports are correlated positively in the process of business cycles with the indicator of excess-supply, in other words, the rate of utilization of productive capacities defined by $1-u=(\bar{Q}-Q)/\bar{Q}$. The distribution of the increase in the ex-ante excessive demand between the augmentation of imports and that of production is itself a increasing function of the rate of utilization of productive capacities. The correlation between imports and disposable capactity of production can make imports be written in the following form.[11]

$$(7) \quad \begin{cases} M = M^d + \Phi\left(\frac{P}{P_m},\ 1-u\right) \\ \text{with} \quad \Phi'_{1-u} < 0, \quad M^d = \text{demand for import} \end{cases}$$

One will remark that this specification introduce not only an influence of the rate of utilization of productive capacities on the volume of imports, but also an influence of this rate on the price-elasticity of imports. This second aspect is generally neglected in the usual specification that one write under the log-linear form :

(8) $M = Q^{\alpha_m}\left(\frac{P}{P_m}\right)^{\beta_m}(1-u)^{-\gamma_m}$

In making the same approximations as for the import-function, one will come to the following log-linear form:

(9) $X = Q_e^{\alpha_x}\left(\frac{P_x^e}{P}\right)^{\beta_x}(1-u^*)^{-\gamma_x}$

with

$u^* = DI/\overline{Q}$

DI: domestic demand in volume addressed to the export-industries. These disequilibriums between demand and supply are, therefore, reabsorbed by a variation of volume of the foreign trades without direct effect on prices. In the usual specification (disequilibrium model), the imports increase under the double effect of the rise of revenue (Q) and of carrying forward the excess-demand on the imports (shown by the decrease of $1-u$), while the prices of imports remain unchanged.(12)

2. The aggregation problem of heterogeneous goods

Taking account of the aggregation will complicate a little the formulations.(13) We are going to show in this paragraph that it would lead in general to different price-elasticities in short term, and to introduce a time-trend translated the structural evolution of relative prices in foreign trades and in productions.(14)

2. 1. General Formulation

Let's consider the model for the good i:

(1 i) $M_i = f_i\left(Q, \frac{P_{m,i}}{P_i}\right)$ $i=1, \cdots\cdots, n$

(2 i) $X_i = g_i\left(Q_e, \frac{P_{x,i}^e}{P_{x,i}}\right)$ $i=1, \cdots\cdots, n$

M_i: Imports of product i (volume);
X_i: Exports of product i (volume);
P_i: Price of domestic production of product i;
$P_{m,i}$: Price of imports of product i;
$P_{x,i}$: Price of exports of product i;

$P^e_{x,i}$: Foreign prices in franc of product i;

The structure by product of aggregates will be characterized by the following parameters (Noting Q_i the domestic production of good i and $Q_{e,i}$ the foreign production):

$$(10)\quad \begin{cases} \lambda_i = \dfrac{P_{m,i}M_i}{P_m M} & \mu_i = \dfrac{P_{x,i}X_i}{P_x X} \\[2ex] \lambda'_i = \dfrac{P_i Q_i}{PQ} & \mu'_i = \dfrac{P_{e,i}Q_{e,i}}{P_e Q_e} \end{cases}$$

with

$$\sum_i \lambda_i = \sum_i \lambda'_i = \sum_i \mu_i = \sum_i \mu'_i = 1$$

The differentiation of accountable equation defining aggregate magnitudes provide us with the relations between the elementary aggregate prices and quantities indices. One obtains respectively: [15]

$$(11)\quad \begin{cases} \dfrac{dP_m}{P_m} = \sum_i \lambda_i \dfrac{dP_{m,i}}{P_{m,i}}, & \dfrac{dM}{M} = \sum_i \lambda_i \dfrac{dM_i}{M_i} \\[2ex] \dfrac{dP_x}{P_x} = \sum_i \mu_i \dfrac{dP_{x,i}}{P_{x,i}}, & \dfrac{dX}{X} = \sum_i \mu_i \dfrac{dX_i}{X_i} \\[2ex] \dfrac{dP}{P} = \sum_i \lambda'_i \dfrac{dP_i}{P_i}, & \dfrac{dQ}{Q} = \sum_i \lambda'_i \dfrac{dQ_i}{Q_i} \\[2ex] \dfrac{dP^e_x}{P^e_x} = \sum_i \mu'_i \dfrac{dP^e_{x,i}}{P^e_{x,i}}, & \dfrac{dQ_e}{Q_e} = \sum_i \mu'_i \dfrac{dQ_{e,i}}{Q_{e,i}} \end{cases}$$

2. 2. The aggregation of revenue-elasticitis and the effects of specialization

The global elasticities are the sum of elementary elasticities, weighted by the structure of foreign trades:

$$\alpha_m = \sum_i \lambda_i \alpha_{m,i}$$

$$\alpha_x = \sum_i \mu_i \alpha_{x,i}$$

These two relations, however, make appear the effects of favorable specialization, or defavorable specialization. It is clear that a country has advantage to specialize on goods of high revenue-elasticity (luxury goods, $\alpha_i > 1$). The share of luxury goods will be small in imports and large in exports from which we can obtain:

$$\alpha_x > \alpha_m$$

However, from the results of estimation, French specialization is rather defavorable.[16]

2. 3. The aggregation of price-elasticities

The variations of prices of elementary products causing a variation of volume in imports are equal to:

$$(12) \qquad \frac{dM}{M} = -\sum_i \beta_{m,i}\lambda_i \frac{dP_{m,i}}{P_{m,i}} + \sum_i \beta_{m,i}\lambda_i \frac{dP_i}{P_i}$$

Suppose that the relative prices were related among them with log-linear relations, then, elementary prices would be expressed in the function of general level of each price by the log-linear relations themselves:

$$(13) \qquad \begin{cases} P_{m,i} = (P_{m,j})^{a_{ij}} e^{\theta_{ij}(t)} \\ P_i = (P_j)^{a'_{ij}} e^{\theta'_{ij}(t)} \\ P_{x,i} = (P_{x,j})^{b_{ij}} e^{\eta_{ij}(t)} \\ P^e_{x,j} = (P^e_{x,j})^{b'ij} e^{\eta'_{ij}(t)} \end{cases}$$

with

$a_{ij},\ a'_{ij},\ b_{ij},\ b'_{ij} > 0$

and

$a_{ji} = \frac{1}{a_{ij}}$ etc.

$\theta_{ji} = -\theta_{ij}$ etc.

In utilizing the definition of the indices of aggregate prices, one obtains:

$$(14) \qquad \begin{cases} P_{m,i} = (P_m)^{a_i} e^{\theta_i(t)} \\ P_i = (P)^{a'_i} e^{\theta'_i(t)} \\ P_{x,i} = (P_x)^{b_i} e^{\eta_i(t)} \\ P^e_{x,i} = (P^e_x)^{b'_i} e^{\eta'_i(t)} \end{cases}$$

with by definition of aggregate prices:

$$(15) \qquad \begin{cases} \sum_i \lambda_i a_i = \sum_i \lambda'_i a'_i = \sum_i \mu_i b_i = \sum_i \mu'_i b'_i = 1 \\ \sum_i \lambda_i \frac{d\theta_i}{dt} = \sum_i \lambda_i \frac{d\theta'_i}{dt} = \sum_i \mu_i \frac{d\eta_i}{dt} = \sum_i \mu'_i \frac{d\eta'_i}{dt} = 0 \end{cases}$$

The only elasticities independent on the structural parameters λ_i are the elasticities between prices P_i and P_j. In consequences, the elasticities defined relative to the general level of prices (a_i) depend upon the following formula:

$$(16)\quad \begin{cases} a_i = \dfrac{1}{\sum_j \lambda_j a_{ji}} \\ d\theta_i = \dfrac{\sum_j \lambda_j d\theta_{ji}}{\sum_j \lambda_j a_{ji}} \end{cases}$$

The global import function could be written, then, as follows:

$$(17)\quad \frac{dM}{M} = -\overbrace{\sum_i \lambda_i a_i \beta_{m,\,i}}^{-\beta_m}\frac{dP_m}{P_m} + \overbrace{\sum_i \lambda_i a'_i \beta_{m,\,i}}^{\beta'_m}\frac{dP}{P} \underbrace{-\sum_i \lambda_i \beta_{m,\,i} d\theta_i(t) + \sum_i \lambda_i \beta_{m,\,i} \theta'_i(t)}_{d\theta(t)}$$

The differences between β_m and β'_m result from the conjugation of three factors, that is to say, the differences among the elementary import-functions ($\beta_{m,\,i}$) between the structure of imports and of production ($\lambda_i \neq \lambda'_i$) and difference of the evolution of relative prices ($a_i \neq a'_i$).

This analysis can only apply to short term where numerous cyclical factors are able to cause the fluctuations of prices each other independently. In the long-run, the relative prices are transformed gradually in the function of the relative productivity of factors of production in each branch, therefore, their evolution, in our model, must be discribed by a simple time-trend. One will write, then, in the long term:

$a_{ij}=1,$ etc.

It is easy to see in utilizing (10), (15) and (16), then:

$a_i = a'_i = b_i = b'_i = 1$

that is to say, all prices are only different from the aggregate price by a function of times. In the long-run, the price-elasticities of elementary import-functions are well aggregated and global elasticities are identical:

$$\beta'_m = \sum_i \lambda_i \beta_{m,\,i} = \beta_m,$$

but it remains a time-trend for the global function.[17]

2. 4. The time-trend and the aggregate model

The aggregation of individual functions will lead not only to the different price-elasticities, but also to a time-trend. A time-trend results from the differences of structure between production and foreign trades :[18]

$$\frac{d\theta}{dt}=\sum_i \lambda_i\beta_{m,\,i}\frac{d\theta'_i}{dt}-\sum_i \lambda_i\beta_{m,\,i}\frac{d\theta_i}{dt}$$

As for the elasticities, one can verify that it disappears in the following two cases :

$\beta_m=\beta_{m,\,i}$ and $\lambda_i=\lambda'_i$

$$\frac{d\theta'_i}{dt}=\frac{d\theta_i}{dt}$$

In the long-run, the price-equations remain homogeneous of degree 1 relative to domestic and foreign prices, but there is a time-trend which represents the structural effects. During the period 1950–1979, the prices follow a parabolic exponential trend, therefore, the relative prices follow the same trend.

The aggregate model would be written, then, in the following way.

$$\log M=\alpha_m \log Q+\beta_m\left[\sum_{i=0}^{S} h_i \log P_m(-i)-\sum_{i=0}^{S} k_i \log P(-i)\right]$$

$$+\gamma_m\cdot\log\frac{1}{1-u}+a_m+b_mt+c_mt^2$$

with

$$\sum_{i=0}^{S} h_i=\sum_{i=0}^{S} k_i=1$$

$$\log P_m=\lambda\log P_m^e+(1-\lambda)\log P+a'_m+b'_mt+c_mt^2$$

and identical formulae for exports.

The introduction of a time-trend during the period can represent other phenomena, totally independent on this relative price effect : the acceleration of foreign trades, owing to the creation of the European Common Market. This acceleration is able to be represented either by an increase of the revenue-elasticities[19] or by a time-trend. Such an effect cannot be isolated from the trend of relative prices by the econometrics.

3. The estimation of imports and exports functions

3. 1. The differenciation of the price-elasticities

The next table 1 show us the estimation of the model with differenciated price-elasticities :[20]

$$\log M = \alpha_m \log Q - \beta_m \log P_m + \beta'_m \log P + \gamma_m \log \frac{1}{1-u}$$
$$+ a_m + b_m t + c_m t^2$$

One can verify that the price-elasticities are significantly different at a limit of probability inferior to 5%. The test of the variances-analysis leads to a ratio of variances of 4.6. The hypothesis of equality of price-elasticities can therefore be rejected with a risk of error inferior to 5% because of $F_{1,25}$ (5%) = 4.3%.

It is not possible to reject the positive auto-correlation of errors. This last factor causing generally an underestimation of variances of the coefficients, therefore, we have done an estimation by the method of Cochrane-Orcutt. The absolute value of elasticities remains significantly different in this case. The auto-correlation explains the incomplete specification of the model, in particular, the lack of lag in the reaction of imports to prices.

For taking account of the fact that the price-elasticities could be distinct in short term, but identical in long-term, it is enough to specify the model with different lags for prices. The following table 2 will give the results for the model :

$$\log M = \alpha_m \log Q + \beta_m (h \log P + (1-h) \log P_{-1})$$
$$- \beta_m (k \log P_m + (1-k) \log P_m(-)1 + \gamma_m \log \frac{1}{1-u}$$
$$+ a_m + b_m t + c_m t^2$$

One remarks that the coefficient of prices to the one-year lagged production is negative, but it is not significantly different from zero : h is in fact superior to 1, but is not significantly different from unity. One can, therefore, keep the hypothesis of an adjustment entirely realized in that year, in constraining the coefficient h to be equal to the unity. One obtains, thens, an elasticity of short-term relative to the prices of imports smaller than that relative to the prices of production :

Table 1. Imports-function with identical elasticities in long-term[22]

$$\log M=\alpha_m \log Q+\beta_m[h \log P+(1-h) \log P_{-1}]-\beta_m[k \log P_m+(1-k) \log P_m(-1)]+\gamma_m \log \frac{1}{1-u}+a_m+b_m t+c_m t^2$$

model \ coefficient	α_m	β_m	h	k	γ_m	a_m	b_m	c_m	DW	SEE (%)	SCR
complete model	1.54 (0.31) 4.89	0.46 (0.16) 2.88	1.74 (0.53) 3.28	0.80 (0.15) 5.33	0.35 (0.16) 2.19	−9.31 (3.51) −2.65	−0.048 (0.021) −2.286	0.1210^{-2} (0.02.10^{-3}) 57.62	1.5	0.27	1.91.10^{-2}
complete model with h=1	1.61 (0.31) 5.42	0.42 (0.17) 2.47	1	0.70 (0.14) 5.0	0.31 (0.17) 1.82	−10.8 (3.46) −3.12	−0.059 (0.020) −2.95	0.1410^{-2} (0.01.10^{-3}) 199.09	1.5	0.26	2.12.10^{-2}
model without tensions (γ_m=0)	2.02 (0.24) 8.42	0.60 (0.17) 3.53	1.42 (0.38) 3.74	0.56 (0.14) 4.0	0	−14.2 (2.9) −4.96	−0.083 (0.014) −5.93	0.1510^{-2} (0.01.10^{-3}) 12.82	1.5	0.29	2.33.10^{-2}
model without tensions (γ_m=0)(h=1)	2.08 (0.24) 8.67	0.56 (0.16) 3.5	1	0.51 (0.14) 3.64	0	−14.9 (2.8) −5.32	−0.088 (0.013) −6.769	0.1510^{-2} (0.01.10^{-3}) 137.27	1.5	0.29	2.45.10^{-2}

Between parenthesis the standard errors of coefficients and t-values.

Table 2. Imports-function, differentiated price-elasticities[23]

$$\log M = \alpha_m \log Q - \beta_m \log P_m + \beta'_m \log P + \gamma_m \log \frac{1}{1-u} + a_m + b_m t + c_m t^2$$

Method of estimation \ Coefficient	Domestic demand $\hat{\alpha}_m$	Prices of imports $-\hat{\beta}_m$	Prices of production $\hat{\beta}'_m$	Rate of utilization $\hat{\gamma}_m$	Characteristics of estimation
M. C. O 1951–1979 $\beta_m \neq \beta_m$	1.98 (0.05) 39.6	−0.24 (0.10) −2.4	0.62 (0.23) 2.70	0.46 (0.11) 4.19	$SCR = 2.75.10^{-2}$ $DW = 1.66$
M. C. O 1951–1979 $\beta_m = \beta'_m$	2.0 (0.05) 40.0	0.16 (0.10) 1.6		0.31 (0.09) 3.44	$SCR = 2.25.10^{-2}$ $DW = 1.50$
CORC 1951–1979 $\beta_m \neq \beta'_m$	1.77 (0.09) 19.67	−0.25 (0.11) −2.27	0.79 (0.17) 4.65	0.35 (0.11) 3.18	$SCR = 2.010^{-2}$ $DW = 2.0$ $\hat{\rho} = 0.83(0.16)$

Between parenthesis the standard-errors of coefficients and t-value

Prices of import $k\beta_m = 0.29$
(0.06)

Prices of production $\beta_m = 0.42$
(0.17)

This result is further supported when one compares the elasticities of the model which do not take account of the influence of tensions:

Prices of import $k\beta_m = 0.29$
(0.08)

Prices of production $\beta_m = 0.56$
(0.16)

This value of elasticities of short-term is, therefore, well compatible with the precedent results and particularly with the interpretation attributing this difference to structural effects.[21]

3. The export-function

The estimations of the export-function incorporating lags without constraints on elasticities of long term:[24]

$$\log X = \alpha_x \log Q_e - \beta_x \log P_x - \varepsilon_x \log P_x(-1) + \beta'_x \log P^e_x$$
$$+ \varepsilon'_x \log P^e_x(-1) - \gamma_x \log \frac{1}{1-u^*} + a_x + b_x t + c_x t^2$$

The effect of the productive capacities is here the ratio of the

Table 3. Export-function

$$\log X=\alpha_x \log Q_e-\beta_x \log P_x-\varepsilon_x \log P_x(-1)+\beta'_x \log P_x^e+\varepsilon'_x \log P_x^e(-1)+\gamma_x \log \frac{1}{1-u}+a_x+b_x t+c_x t^2$$

Simple ordinary least-squares method on 1951-1979[25]

Coefficient Income-elasticities / model	Income-elasticities α_x	Price-elasticities β_x	β'_x	ε_x	ε'_x	γ_x	a_x	b_x	c_x	DW	SEE (%)	SCR
different price elasticities Complete model with u^*	1.06 (0.55)	0.74 (0.32)	0.82 (0.27)	0.84 (0.25)	0.58 (0.22)	0.67 (0.27)	7.71 (2.51)	−0.034 (0.030)	$0.12.10^{-2}$ $(0.02.10^{-2})$	2.0	0.32	2.3510^{-2}
Complete model with u	0.82 (0.70)	1.19 (0.33)	1.18 (0.27)	0.56 (0.30)	0.58 (0.25)	−0.07 (0.19)	6.88 (2.93)	−0.030 (0.040)	$0.13.10^{-2}$ $(0.02.10^{-2})$	1.6	0.36	3.1410^{-2}
Model without tension ($\gamma_x=0$)	0.96 (0.62)	1.15 (0.32)	1.17 (0.26)	0.61 (0.27)	0.59 (0.24)	0	6.62 (2.81)	−0.040 (0.030)	$0.14.10^{-2}$ $(0.02.10^{-2})$	1.6	0.35	2.8410^{-2}
Indentical elasticities Complete model with u^*	1.35 (0.44)	1.02 (0.25)		0.61 (0.22)		0.42 (0.21)	5.63 1.60	−0.055 (0.023)	$0.14.10^{-2}$ $(0.02.10^{-2})$	1.8	0.31	2.8610^{-2}
Complete model with u	0.83 (0.56)	1.17 (0.25)		0.58 (0.23)		−0.07 (0.15)	6.90 (1.95)	−0.030 (0.030)	$0.13.10^{-2}$ $(0.03.10^{-2})$	1.6	0.36	3.1410^{-2}
Model without tensions ($\gamma_x=0$)	0.99 (0.43)	1.18 (0.25)		0.59 (0.23)		0	6.44 (1.65)	−0.040 (0.023)	$0.14.10^{-2}$ $(0.02.10^{-2})$	1.6	0.36	3.1812^{-2}

Between parenthesis the standard-errors of coefficients domestic demand adressed to the national producers to the capacity of production: $u^* = \frac{DI-M}{\overline{Q}}$. In fact, it is $u^* = \frac{Q-X}{\overline{Q}}$ in the case of export-function. The table 3 shows that this ratio would be always very significant in the estimations, and that the price-elasticities are neither significantly different in short term nor in long term ($\beta_x = \beta'_x$, $\varepsilon_x = \varepsilon'_x$). The hypothesis of an adjustment-log of exports to the variations of competitivity is well validated by the estimations in the table 3.

Note

(1) F. Fournelle, P.-A. Muet et P. Villa, Le Commerce extérieur en France depuis 1950 : Une étude économétrique des fonctions agrégées, Paris, Annales de l'inséé, Numéro 49 — Janvier — Mars 1983. PP. 53–57.

(2) ibid., PP. 56–57.

(3) A. P. Lerner, The Economics of Control. — Principles of Welfare Economics, — Mac Millan, New York, 1944. J. Robinson, The Foreign Exchanges, in Essays in the Theory of Employment, Part 3, chap. 1, Basil Black-well, Oxford. 1947.

(4) F. Fournelle, P.-A. Muet et P. Villa, op. cit., P. 57.

(5) ibid., PP. 57–58.

(6) In order to obtain both equations (5) and (6), we put the equations (1) and (2) equal to those (3) and (4)

$$Q^{\alpha_m}\left(\frac{P}{P_m}\right)^{\beta_m} = (\overline{Q}_e)^{\alpha'_m}\left(\frac{P_m}{P_m^e}\right)^{\delta_m}$$

$$\left(\frac{1}{P_m}\right)^{\beta_m} = P^{-\beta_m} \cdot Q^{-\alpha_m} \cdot (\overline{Q}_e)^{\alpha'_m}(P_m)^{\delta_m} \cdot (P_m^e)^{-\delta_m}$$

$$P_m^{-(\beta_m+\delta_m)} = (P_m^e)^{-\delta_m} \cdot P^{-\beta_m} \cdot Q^{-\alpha_m}\overline{Q}_e^{\alpha'_m}$$

$$P_m = (P_m^e)^{\frac{\delta_m}{\beta_m+\delta_m}} \cdot P^{\frac{\beta_m}{\beta_m+\delta_m}} \cdot Q^{\frac{\alpha_m}{\beta_m+\delta_m}} \cdot \overline{Q}_e^{\frac{-\alpha'_m}{\beta_m+\delta_m}}$$

$$\therefore \quad P_m = (P_m^e)^{\lambda} P^{1-\lambda} Q^{\frac{\alpha_m}{\beta_m+\delta_m}} \overline{Q}_e^{\frac{-\alpha'_m}{\beta_m+\delta_m}}$$

$$\lambda = \frac{\delta_m}{\beta_m+\delta_m}$$

$$(Q_e)^{\alpha_x}\left(\frac{P_x^e}{P_x}\right)^{\beta_x} = (\overline{Q})^{\alpha'_x}\left(\frac{P_x}{P}\right)^{\delta_x}$$

$$P_x^{-(\beta_x+\delta_x)} = (P_x^e)^{-\beta_x} \cdot P^{-\delta_x} \cdot Q_e^{-\alpha_x} \cdot \overline{Q}^{\alpha'_x}$$

$$P_x = (P_x^e)^{\frac{\beta_x}{\beta_x+\delta_x}} \cdot P^{\frac{\delta_x}{\beta_x+\delta_x}} \cdot Q_e^{\frac{\alpha_x}{\beta_x+\delta_x}} \cdot \overline{Q}^{\frac{-\alpha'_x}{\beta_x+\delta_x}}$$

$$\therefore \quad P_x = (P_x^e)^{\mu} P^{1-\mu} Q_e^{\frac{\alpha_x}{\beta_x+\delta_x}} \overline{Q}^{\frac{-\alpha'_x}{\beta_x+\delta_x}}$$

$$\mu = \frac{\beta_x}{\beta_x + \delta_x}$$

(7) ibid., P. 58.

(8) M. Catinat, Disequilibrium Foundations for Exports and Imports, l'INSEE, Paris, 1982.

(9) F. Fournelle, P.-A. Muet et P. Villa, op. cit., P. 59.

(10) ibid., P. 59. and "Keizai-Yōran" of Japan, 1985.

(11) ibid., PP. 59–60.

(12) ibid., PP. 59–60.

(13) ibid., P. 62.

(14) T. Murray and P. J. Ginman, An Empirical Examination of the Trading Aggregate Import Demand Model, The Review of Economics and Statistics, vol. 58, February, 1976. PP. 75–80.

(15) F. Fournelle, P.-A. Muet et P. Villa, op. cit., PP. 62–63.

(16) ibid., P. 64.

(17) ibid., PP. 64–66.

(18) ibid., PP. 67–68.

(19) F. Fournelle, P.-A. Muet et P. Villa, Le commerce extérieur en France depuis 1950 : Une étude économétrique, Working Paper CEPREMAP, n° 8124.

(20) ibid., PP. 69–72.

(21) ibid., P. 71.

(22) ibid., P. 70.

(23) ibid., P. 71.

(24) ibid., P. 72.

(25) ibid., P. 72.

III. Estimations of Japan's import-functions (1968–1984)

After having taken consideration of the French import and export-functions in detail, we have estimated Japan's import functions based on the same theoretical frameworks as the French analysis. The issues of frictions in Japan's foreign trades have been recently the most difficult and serious problems to solve between the Japanese and both the United States and the Western European economies. This is the reason why we are going to show the results of our estimations of the Japan's import functions, starting from the statistical data from 1968 to 1984.

First of all, we have computed a simple Japan's import-function of the period as the following :[1]

$$\log M = -5.970 + 0.813 \log Q + 0.850 \log P + 0.892 \log P_m$$
$$\quad (-5.1432)\ (6.1699) \qquad (6.3413) \qquad (12.8782)$$
$$-0.354 \log P_m(-1) \qquad (1)$$
$$(-6.3410)$$

$\bar{R}^2 = 0.997531 \qquad S = 0.54 \qquad DW = 1.94$

Estimation-Period Covered: 1968–1984

The results of the calculations of equation (1) indicate the following with regard to Japan's imports.(2) All sign-conditions of regression coefficients are satisfied from the point of view in the usual theoretical assumptions. From the fact that all coefficients have a high degree of significance and the fact that the coefficient of determination after adjustment of degree of freedom is extremely high, it is clear that the growth in Japan's G. N. P., the price level at home and import-prices are the chief factors in the expansion of Japan's imports. Furthermore, the ratio of Durbin Watson (DW) is equal to 1.94, which show the lack of serial correlation in error-terms. The value of coefficient on the variable of Japan's Real G. N. P. in equation (1) is just a little inferior, or rather the same to the estimate of the elasticity of Japan's import relative to the level of Real G. N. P. which had been already calculated by Mr. Hisao Kanamori during the period 1955–1968, that is 0.89.(3) In spite of the enormous changes of economic structures in Japan after the 1970s, owing to the upward revaluation of yen, both the first and the second oil crisis in 1973 and in 1979, the value of the elasticity of Japan's import relative to production at home has remained almost unchanged, according to the comparison between the estimate by Mr. Kanamori and that of our computation. From 1951 to 1973 the rate of growth in the Real G. N. P. had been about 10% per annum,(4) however, after the first shock of the oil crisis at the end of 1973 the rate of increase in the Japan's production had decelerated to the level of 5 per cent per year in 1970s and after the second oil crisis both in 1979 and 1980 the rate of growth has declined still further to the level of about 3 or 4 per cent a year.(5) However, the value of coefficient α_m which stands for the elasticity of the quantity of Japan's imports relative to the real value of G. N. P.: $\left(\alpha_m = \frac{\Delta M_j}{M_j} \Big/ \frac{\Delta Q_j}{Q_j}\right)$ has not almost changed even after the era of rapid growth. Recently the Japanese government try to increase her domestic demands for augmenting Japan's imports, but basing on the estimated value for equation (1), elasticity was about 0.813 throughout the period from 1968 to 1984. In other words, we have had to come to the conclusion, therefore, that the economic policies advocated nowadays by the government in the view of demand-increase at home do not seem to be very effective for achieving the goal of import-augmentations. Of course, these policies which are the action-programs by government, the reductions in tariffs and the rise in government expenditures for public enterprises are somewhat efficient for decreasing the surplus of international trades, however, the constancy in elasticity parameter α_m between the era of rapid growth and the post oil-crisis period must be profoundly considered in carrying out these policies.(6)

The results(7) of estimation of equation (2) indicate the almost similar characteristics to the previous equation (1) with regard to Japan's imports: that is to say that all coefficients have a significants t-value of a high degree and the coefficient of determination after adjustment of degree of freedom is approximately equal to unity. All sign-conditions are fully satisfied and the ratio of Durbin-Watson is 2.46.

$$\begin{aligned} \log M = &-6.671 + 0.890 \log Q + 1.392 \log P - 0.646 \log P_{-1} \\ &\quad(-6.3715)(7.5089) \qquad (5.2460) \qquad (-2.2713) \\ &\quad + 0.836 \log P_m - 0.246 \log P_m(-1) \qquad\qquad (2) \\ &\quad (12.9741) \qquad (-3.6267) \end{aligned}$$

$\bar{R}^2 = 0.998151 \qquad S = 0.54 \qquad DW = 2.46$

Estimation-Period Covered: 1968–1984

After the equation (2), we must introduce the rate of utilization of productive capacities and time-trends into our models just like the French analysis:

$$\begin{aligned} \log M = &-39.927 + 3.434 \log Q + 1.546 \log P + 0.865 \log P_m \\ &\quad(-3.6109)(4.2603) \qquad (2.8978) \qquad (10.6168) \\ &\quad -0.008 \log \frac{1}{1-u} - 0.282t + 0.005t^2 \qquad\qquad (3) \\ &\quad (-0.9700) \qquad\quad (-2.5249)(1.7828) \end{aligned}$$

$\bar{R}^2 = 0.996872 \qquad S = 0.54 \qquad DW = 2.5$

Estimation-Period Covered: 1968–1984

The result[8] of the calculation of model (3) is a little different from those of equations (1) and (2) concerning Japan's imports. The parameters of explicative variables, both the rate of utilization of productive capacities and the second-degree term of time-trend, are not significant with regard to 5% of the significance level. The ratio of Durbin-Watson is equal to 2.5.

As a final step of our calculation we have estimated the model (4) as follows:

$$\begin{aligned}
\log M = & -23.051 + 2.144 \log Q + 1.297 \log P - 0.128 \log P_{-1} \\
& \quad (-2.0885)(2.6409) \qquad (3.3333) \quad (-0.7532) \\
& + 0.906 \log P_m - 0.209 \log P_m(-1) - 0.007 \log \frac{1}{1-u} \\
& \quad (13.6890) \quad (-3.1501) \qquad\qquad (-1.0904) \\
& - 0.141t + 0.003t^2 \\
& \quad (-1.3122)(1.0239)
\end{aligned} \tag{4}$$

$\bar{R}^2 = 0.998444 \qquad S = 0.54 \qquad DW = 3.17$

Estimation-Period Covered: 1968–1984

The fourth equation (4) which is the same model as the French model computed already on the period covered 1951–1979 inform us the following incompete results of estimation.[9] The calculated parameters concerning with the lagged price level at home (P_{-1}), the rate of utilization of productive capacities $\left(\frac{1}{1-u}\right)$, one-degree term of time-trend and the second degree term of time-trend are not significant with respect to 5% of significance level. The ratio of Durbin-Watson is 3.17 which show the existence of negative serial correlation of error-terms.

As for the Japan's export-functions, there are not very difficult problems to overcome now, therefore, we are going to simply cite the estimations by Professor Nakamura as follows:[10]

$$\log E_j = 0.00000021445 + 1.8165 \log M_w + 1.331 \log\left(\frac{P_j}{P_w}\right)$$

$$(24.125) \qquad (3.6154)$$

$R^2 = 0.9909$

Estimation Period Covered 1951–70

$$\log E_j = 1.5480 + 1.1713 \log M_w - 0.48146 \log\left(\frac{P_j}{P_w}\right)$$
$$(11.929) \qquad (-0.88802)$$

$R^2 = 0.986722$

Estimation Period Covered 1968–1975

M_w : total world imports in US $ 100 millions.

P_w : world export price index in the UN unit price index.

P_j : Japan's export price index obtained by adjusting the Bank of Japan export price index to 1958 price levels

E_j : the value of Japan's exports

Note

(1) JMA Research Institute (Nippon Nōritsu-Kyokai Sōgo-Kenkyujo) Inc., Multiple Regression Analysis System V 2·0, JRI Software Library, N°. 2511, 1985.

(2) Economic Planning Agency : Government of Japan, Annual Summary Report on National Accounts (Keizai Yōran) and Annual Report on National Accounts, Economic Research Institute, Economic Planning Agency, Tokyo, 1985.

(3) Hisao Kanamori, The Variations and Estimations of the Japanese Economy, Nippon Keizai Shinbun inc, Tokyo, 1969, P. 198.

(4) Takafusa Nakamura, The Postwar Japanese Economy, University of Tokyo Press, Tokyo, 1981, P. 49.

(5) Kimihiro Shōmura, The Postwar History, Chikuma Shōbo, Tokyo, 1985.

(6) Herman Kahn and Thomas Pepper, In spite of that the Japan can grow, Simul Press, Tokyo, 1978.

(7) JMA Research Institute, op. cit., N° 2511.

(8) JMA Research Institute, op. cit.. N° 2511.

(9) JMA Research Institute, op. cit., N° 2511.

(10) Takafusa Nakamura, op. cit., PP. 56–59.

IV. Conclusion

According to the results of the computations of equations both (1) and (2) with regard to Japan's imports, there are no significant differences in the values of the elasticity of Japan's import relative to the level of Japan's real GNP between the value (0.8957) by Mr. Kanamori in the era of rapid growth and our estimates (both 0.813 and 0.890) concerning to the post oil-crisis period. Regarding to the values of elasticities of equations both (3) and (4), we can find out the calculations corresponding to the values (3.434 and 2.144) which would be significantly different from that[1] in the period of rapid growth. However, both models (3) and (4) contain two or four non-significant parameters,[2] we cannot but say, therefore, that these equations were not able to be utilized for some econometric conclusions.

As for the elasticities of Japan's imports relative to the price-level at home, we have been able to get some plausible values for both current and lagged prices.

Finally, concerning to the elasticities relative to the prices of imports, the estimated parameters for the import-prices have a high degree of significance and theoretically consistent sign-conditions. We could arrive at the conclusion, therefore, that the upward revaluation of yen with regard to the current cheap exchange rate against the foreign currencies, especially against the U. S. dollors, by some international methods of negociations[3] would be somewhat effective to overcome the frictions of foreign trades, owing to the increase in Japan's imports and the decrease in Japan's exports.

Other factors in both equations (3) and (4), the rate of utilization of productive capacities and the time trends have non-significant values of parameters, so we cannot indicate these explicative variables such as the french import-functions do for the French economy. We had better, or rather had to, construct different import-functions to explain well the nowadays' Japan's imports from the theoretical and econometric points of view with these respects.

Note

(1) Hisao Kanamori, op. cit., P. 189.

(2) Parameters with regards to the rate of wilization of productive capacities $\left(\frac{1}{1-u}\right)$ and the time trends $(a_m+b_mt+c_mt^2)$, in particular, to a_m and c_m.

(3) Some simple theoretical assumptions.